Exhibit 15

Exhibit 15
Infringement Claim Chart for U.S. Patent No. 10,134,398 ("the '398 patent")

Sonos Products directly and/or indirectly infringe Claims 1-5, 7-13, and 15-20 ("Asserted Claims") of U.S. Patent No. 10,134,398 ("the '398 patent"). The Sonos Products that infringe the '398 patent include at least the Sonos Move, Sonos Roam, Sonos Arc, Sonos Beam, and Sonos One (collectively the "Accused Voice Products").

The Accused Voice Products infringe the '398 patent because they include systems, processors, and/or methods that support the Sonos Voice Control feature and provide for remaining in a low power mode, as claimed in the '398 patent. Additionally, the Sonos One device is representative of the Accused Voice Products at least because the other Accused Voice Products function in the same or substantially similar manner to the Sonos One device. Sonos' marketing, customer support, and other technical information describe the relevant aspects of Sonos Voice Control in the same way for all Sonos devices, including each of the Accused Voice Products.[1] Testing of multiple different Sonos devices further confirms that the Sonos Voice Control feature operates in the same or substantially similar manner on the different devices. Thus, on information and belief, the Sonos Voice Control functionality described in this chart for the Sonos One device implements the same code base (e.g., the Sonos S2 operating system) as the other Accused Voice Products to function in the same or substantially similar way for all products that support Sonos Voice Control, including each of the Accused Voice Products.

Google contends each of the following limitations is met literally, and to the extent a limitation is not met literally, it is met under the doctrine of equivalents.

References:
- *Sonos One*, Sonos.com, https://www.sonos.com/en-us/shop/one (Ex. 8)
- *Sonos Power Consumption While Idle*, Sonos.com, https://support.sonos.com/s/article/256 (Ex. 9)
- *Sonos One User Guide*, Sonos.com, https://www.sonos.com/en-us/guides/one (Ex. 10)
- *Sonos Voice Control User Guide*, Sonos.com, https://www.sonos.com/en-us/guides/sonosvoicecontrol (Ex. 11)
- *On-Device Voice Control on Sonos Speakers*, Sonos Tech Blog, https://tech-blog.sonos.com/posts/on-device-voice-control-on-sonos-speakers/ (Ex. 12)

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[1]   See Sonos Voice Control, Sonos.com, available at https://www.sonos.com/en-us/sonos-voice-control; Sonos Voice Control, Sonos Support, available at https://support.sonos.com/s/topic/0TO8V000000HWlgWAG/sonos-voice-control; "On-device voice control on Sonos speakers," Sonos Tech Blog, available at https://tech-blog.sonos.com/posts/on-device-voice-control-on-sonos-speakers/.

- *Sonos Voice Control*, Sonos.com, https://www.sonos.com/en-us/sonos-voice-control (Ex. 13)

Claims	Accused Voice Products
[1.pre] 1. A computer-implemented method comprising:	The Accused Voice Products are computing devices that perform a computer-implemented method. For example, the Sonos One includes a central processing unit (CPU) and software to perform elements [1.1] through [1.4].

Tech Specs

Audio   Details + Dimensions   **Power + Connectivity**   Box Contents   Requirements

WiFi	Voltage	Ethernet
Connect to WiFi with any 802.11a/b/g/n 2.4 or 5 GHz broadcast-capable router.	100-240V 50/60Hz internal power supply	10/100 port for hardwiring to your router
Learn more		

CPU	Memory	Apple AirPlay 2
Quad Core 1.4 GHz A-53	1GB SDRAM 4GB NV	Works with AirPlay 2 on Apple devices iOS 11.4 and higher
		Learn more
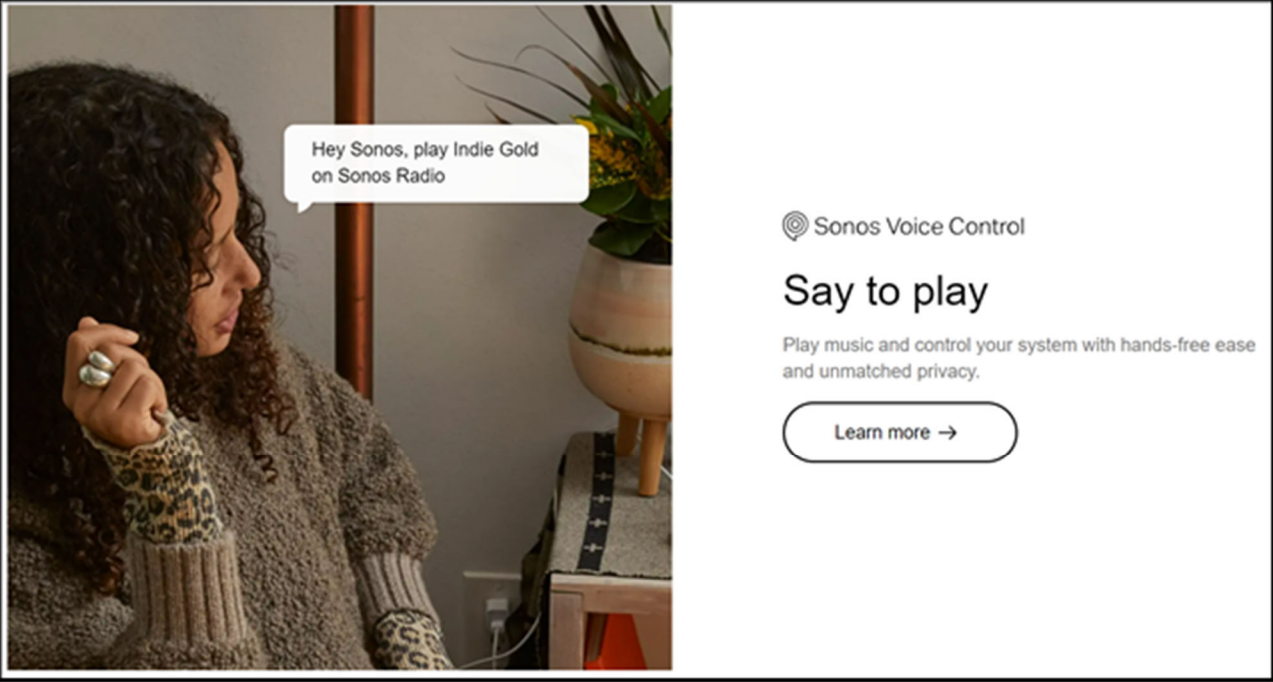
See Sonos One, Sonos.com, https://www.sonos.com/en-us/shop/one. Each of the other Accused Voice Products also include a central processing unit and software instructions to perform operations. *See* https://www.sonos.com/en-us/shop/roam; https://www.sonos.com/en-us/shop/move; https://www.sonos.com/en-us/shop/arc; https://www.sonos.com/en-us/shop/beam.

The Sonos One device is a voice-enabled device that supports the Sonos Voice Control feature.

See Sonos One, Sonos.com, https://www.sonos.com/en-us/shop/one. Each of the other Accused Voice Products also supports Sonos Voice Control. *See* https://www.sonos.com/en-us/shop/roam; https://www.sonos.com/en-us/shop/move; https://www.sonos.com/en-us/shop/arc; https://www.sonos.com/en-us/shop/beam.

[1.1] receiving, by a computing device that is in a low power mode and that is configured to exit a low power mode upon detecting an utterance of a particular,	The Accused Voice Products are computing devices that enter a low power mode and that are configured to exit the low power mode upon detecting an utterance of a particular, predefined hotword using an on-device hotword detector. In addition, the Accused Voice Products receive audio data that correspond to an utterance of the particular, predefined hotword while in the low power mode. For example, the Sonos One enters an "idle mode" in which the Sonos One "use[s] minimal electricity when powered on and not playing music."

predefined hotword using an on-device hotword detector, audio data that corresponds to an utterance of the particular, predefined hotword;	Sonos Power Consumption While Idle

predefined hotword using an on-device hotword detector, audio data that corresponds to an utterance of the particular, predefined hotword;

Sonos Power Consumption While Idle

Sonos products are designed to use minimal electricity when powered on and not playing music. The table below describes the power consumed by each Sonos product while in idle mode, measured in Watts. Watts is a unit of power, not to be confused with W-hr (represents how much energy was used in some period of time).

Product	120V (North America)	230V (European Union)
Play:1	3.4 Watts	3.8 Watts
One (gen1)[1]	3.8 Watts	4.1 Watts
One (gen2)[1]	3.1 Watts	3.4 Watts
One SL	3.0 Watts	3.4 Watts
Play:3	4.1 Watts	4.4 Watts

Idle is defined as audio muted or paused on all players in the household for at least 3 minutes, and no audio signal is being sent to a line-in connection or home theater player (in most cases, this means that the TV is off).

All Sonos components take 3 minutes to go into idle mode, unless part of a Sonos home theater surround setup. The 3 minutes until idle can be initiated on a surround setup when audio is paused. If pause or mute is not initiated, idle power mode takes 13 minutes for all devices part of a surround setup after the audio signal ceases from the TV.

See Sonos Power Consumption While Idle, Sonos.com, https://support.sonos.com/s/article/256

On information and belief, microphones of the Sonos One are powered, or capable of receiving signals, when the Sonos One is in idle mode. In this low power mode, the Sonos One waits for and receives audio data that includes an utterance of the particular, predefined hotword "Hey Sonos."

See Sonos One, Sonos.com, https://www.sonos.com/en-us/shop/one

Voice services

Use your voice to control your Sonos system with any voice-enabled Sonos product—play and control content, turn the volume up or down, and more.

- **Sonos Voice Control**: control your whole Sonos system with hands-free ease and unmatched privacy. Sonos Voice Control comes ready to use—it only takes a few seconds to add when you set up your speakers. **More information**

- **Amazon Alexa**: you'll need the Sonos app and the Alexa app with the Sonos skill enabled. You'll make some changes in both apps during setup. **Learn more**

- **Google Assistant**: you'll need the Sonos app and the Google Assistant app. You'll make some changes in both apps during setup. **Learn more**

- **Siri**: you'll need the Apple Home app. Add your AirPlay2-compatible Sonos speakers to the Apple Home app and then use an iPhone, iPad, or Apple TV to ask Siri to play music (currently limited to Apple Music). **Learn more**

See Sonos One User Guide, Sonos.com, https://www.sonos.com/en-us/guides/one

Easy voice requests

Start the music, adjust the volume, pause, and move the sound all around your system without lifting a finger. Control your whole Sonos system with any voice-enabled Sonos product.

Just begin your request with "Hey Sonos..."

Common voice requests you can now make with Sonos Voice Control:

- "Hey Sonos, play a little quieter."

- "Hey Sonos, what's playing?"

- "Hey Sonos, pause."

- "Hey Sonos, play NPR."

- "Hey Sonos, turn the TV on."

See Sonos Voice Control User Guide, Sonos.com, https://www.sonos.com/en-us/guides/sonosvoicecontrol

The Sonos One exits the low power mode upon detecting an utterance of the particular, predefined hotword "Hey Sonos" using an on-device hotword detector. For example, the Sonos One touts the ability to alleviate privacy concerns by having "a wake word detector [that] is continuously listening for a predefined keyword" "run[ning] on the speaker itself." "The voice recognition stack run[ning] directly on Sonos speakers," meaning the audio data is "never sent to a centralized cloud server."

First, the **audio front-end** processes the signals from the speaker's microphones and applies a series of transformations in order to get the final, enhanced audio signal passed on to the downstream components. The goal of the audio front-end is to clean the input signal and remove parasitic interferences, such as background noise, reverberation due to the reflection of the sound on the walls or objects placed within the room, and especially self-sound (the music playback from the speaker itself). Such speech enhancement systems typically combine digital signal processing techniques incorporating domain knowledge about physics and perception, together with machine learning models to increase the model's power to generalize. The role of the audio front-end is illustrated on the following two audio files:

Next, a **wake word detector** is continuously listening for a predefined keyword in the cleaned audio stream , to initiate an interaction with the voice assistant. The wake word detector runs on the speaker itself (sometimes with additional verification steps in the cloud), and it is usually a deep neural network that maps an audio sequence to a binary output: whether or not the wake word is present inside the audio input. The wake word, like the audio front-end, processes every chunk of voice captured by the microphone. As soon as the wake word is detected, the most common behavior is to stream the subsequent audio directly to a remote server where the next steps are performed.

The voice recognition stack runs directly on Sonos speakers. The voice of the user is processed locally and is never sent to a centralized cloud server. The machine learning models are trained on scripted audio data and then deployed for inference on the smart speakers. Potential wake word false triggers are therefore not a privacy concern anymore, because no audio data is sent to the cloud after the wake word is detected. This embedded approach is arguably the most straightforward and transparent way to perform privacy-preserving speech recognition. It is simpler to trust and comprehend for non-experts than other approaches like differential privacy, or speech anonymization, where a statistically positive amount of information still leaves people's homes to feed and improve centralized machine learning models.

	Privacy: Closed domain models are smaller and require less training data. With Sonos Voice Control, we show that large scale personal data collection is not a requirement to provide a satisfying user experience on a single yet very challenging domain. The Sonos voice engine processes your voice and understands your requests entirely on the speaker. No audio or transcript is sent to the cloud, stored, listened to, read or labeled by anyone, so all the conversations in a user's home remain in the home.

Follow-up requests: This approach enables the Sonos voice engine to keep locally processing the audio stream even after the users are done with their initial voice request, without compromising their privacy. As a result, simple additional commands (like adjusting the volume or skipping a song) may be understood without repeating the wake word. This functionality, when present, is only an opt-in on other voice assistants.

Personalization: The embedded approach makes it natural for every device to get their own voice engine instead of having a single model on a centralized cloud server. Therefore, the local model can be adapted to the content of the customer's personal library. That means it will understand the names of the songs and artists they've saved and liked or the playlists they've created on their preferred music streaming services.

On-Device Voice Control on Sonos Speakers, Sonos Tech Blog, https://tech-blog.sonos.com/posts/on-device-voice-control-on-sonos-speakers/

On information and belief, each of the Accused Voice Products supports the features described above in the same way, and therefore meet this limitation in the same manner as the exemplary products identified above. |
| [1.2] while the computing device remains in the low power mode, and in | The Accused Voice Products transmit an output of processing the audio data using the on-device hotword detector to another computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword. In addition, the Accused Voice Products transmit the |

response to receiving the audio data that corresponds to the utterance of the particular, predefined hotword, transmitting, by the computing device and to another computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an output of processing the audio data using the on-device hotword detector;	output while in the low power mode, and in response to receiving the audio data that corresponds to the utterance of the particular, predefined hotword. For example, the Sonos One transmits a "WakeWord" message to another computing device (e.g., another Sonos One) while in the low power mode, in response to receiving the audio data that includes the utterance of the hotword "Hey Sonos." The image below shows a broadcast message from the Sonos One to another Sonos One while in idle mode upon a user's utterance of the hotword "Hey Sonos." The broadcast message includes an output of processing the audio data using the on-device hotword detector at least in the form of the message "WakeWord," an arbitration metric, and/or other data included in the message. During this broadcast message, the other Sonos One is also in idle mode. ```\n{\n "message": "WakeWord",\n "data": {\n "serial": "███████████████████████",\n "in_session": false,\n "arbitration_metric": 33.15017,\n "muse_household_id": "██████████████████████████████████",\n "device_id": "████████████████",\n "message_serial": "██████████████████████"\n }\n}\n``` "WakeWord" Message Transmitted Upon Receiving Hotword "Hey Sonos" If the Sonos One device is in an "Idle" state (i.e., a low power mode) prior to detection of the "Hey Sonos" hotword, it transmits the "WakeWord" message while it remains in the "Idle" state. This is confirmed by messages transmitted between the Sonos devices and controller application, which include parameters named "IsIdle" and "IdleState" having values of "1", indicating that the Sonos One device remains in an "Idle" state at the time that it transmits the "WakeWord" message. Measurements of the power consumption of the Sonos One device further confirm that it remains in the low power state at the time that it transmits the "WakeWord" message.

	On information and belief, each of the Accused Voice Products supports the features described above in the same way, and therefore meet this limitation in the same manner as the exemplary products identified above.

[1.3] while the computing device remains in low power mode, receiving, by the computing device and from the other computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an additional output of processing the audio data; and	The Accused Voice Products, while remaining in the low power mode, receive from another computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an additional output of processing the audio data.
	
	For example, the Sonos One receives an additional WakeWord message from a nearby device (e.g., another Sonos One) that is in a low power mode. The image below shows another broadcast message from another Sonos One in idle mode upon a user's utterance of the hotword "Hey Sonos." The additional broadcast message includes an output of processing the audio data at least in the form of the message "WakeWord," an arbitration metric, and/or other data included in the message.
	
	``
	{
	    "message": "WakeWord",
	    "data": {
	        "serial": "████████████████████████",
	        "in_session": false,
	        "arbitration_metric": 34.250324,
	        "muse_household_id": "████████████████████████████",
	        "device_id": "████████████████",
	        "message_serial": "████████████████████"
	    }
	}
	``
	"WakeWord" Message Received From Another Sonos One
	
	The Sonos One will also remain in the "Idle" state when it receives the "WakeWord" message transmitted by nearby Sonos devices. This is confirmed by messages transmitted between the Sonos devices and controller application, which include parameters named "IsIdle" and "IdleState" having values of "1", indicating that the Sonos One device remains in an "Idle" state at the time that it receives the "WakeWord" message. Measurements of the power consumption of the Sonos One device further confirm that it remains in the low power state at the time that it receives the "WakeWord" message.

	On information and belief, each of the Accused Voice Products supports the features described above in the same way, and therefore meet this limitation in the same manner as the exemplary products identified above.
[1.4] after transmitting the output of processing the audio data using the on-device hotword detector and after receiving the additional output of processing the audio data from the other using device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, determining, by the computing device, to remain in the low power mode.	The Accused Voice Products determine to remain in the low power mode after transmitting the output of processing the audio data using the on-device hotword detector and after receiving the additional output of processing the audio data from the other using device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword. For example, the Sonos One compares the value of the variable "arbitration_metric" in the WakeWord messages to determine whether its arbitration metric is the highest. If not, it determines it is not the arbitration winner and it remains in the low power mode.

```
{
    "message": "WakeWord",
    "data": {
        "serial": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓",
        "in_session": false,
        "arbitration_metric": 33.15017,
        "muse_household_id": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓",
        "device_id": "▓▓▓▓▓_▓▓▓▓▓",
        "message_serial": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓"
    }
}


{
    "message": "WakeWord",
    "data": {
        "serial": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓",
        "in_session": false,
        "arbitration_metric": 34.250324,
        "muse_household_id": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓",
        "device_id": "▓▓▓▓▓_▓▓▓▓▓",
        "message_serial": "▓▓▓▓▓▓▓▓▓▓▓▓▓▓"
    }
}
```

Not highest arbitration metric =
Remain in low power mode
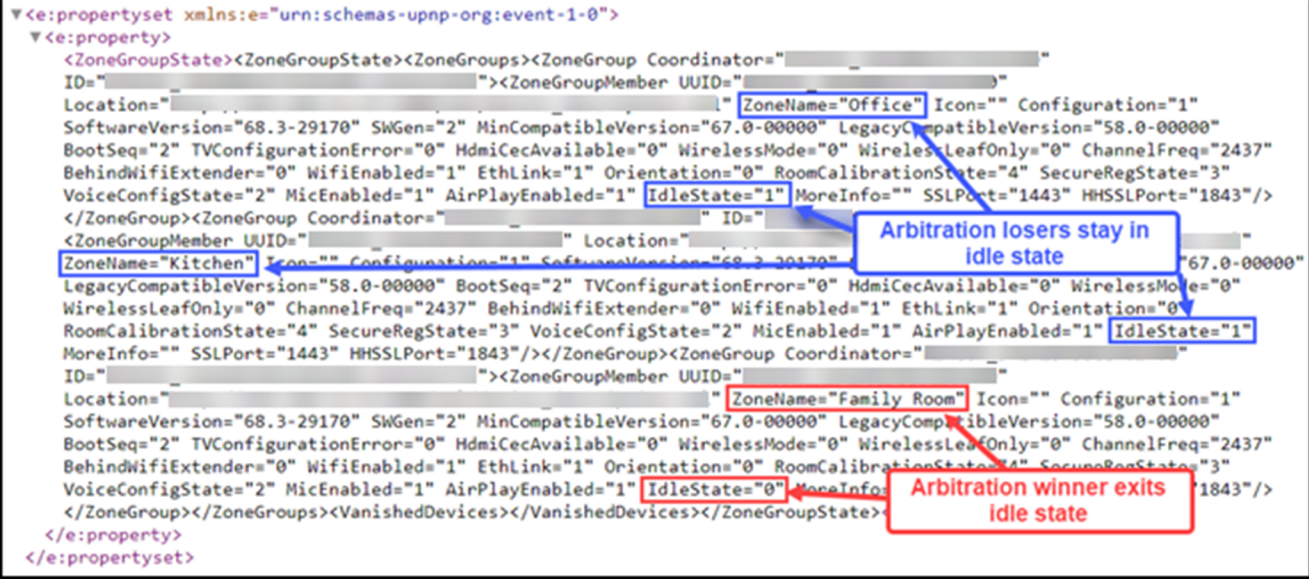
Arbitration Metric Comparison to Determine to Remain in Low Power Mode

For instance, when a user says "Hey Sonos, play Apple Music 1 in the kitchen," a Sonos One that wins arbitration exits low power mode and responds "Playing Apple Music 1 in the kitchen." Conversely, a Sonos One that does not win arbitration remains in low power mode and does not respond.

See Sonos Voice Control, Sonos.com, https://www.sonos.com/en-us/sonos-voice-control
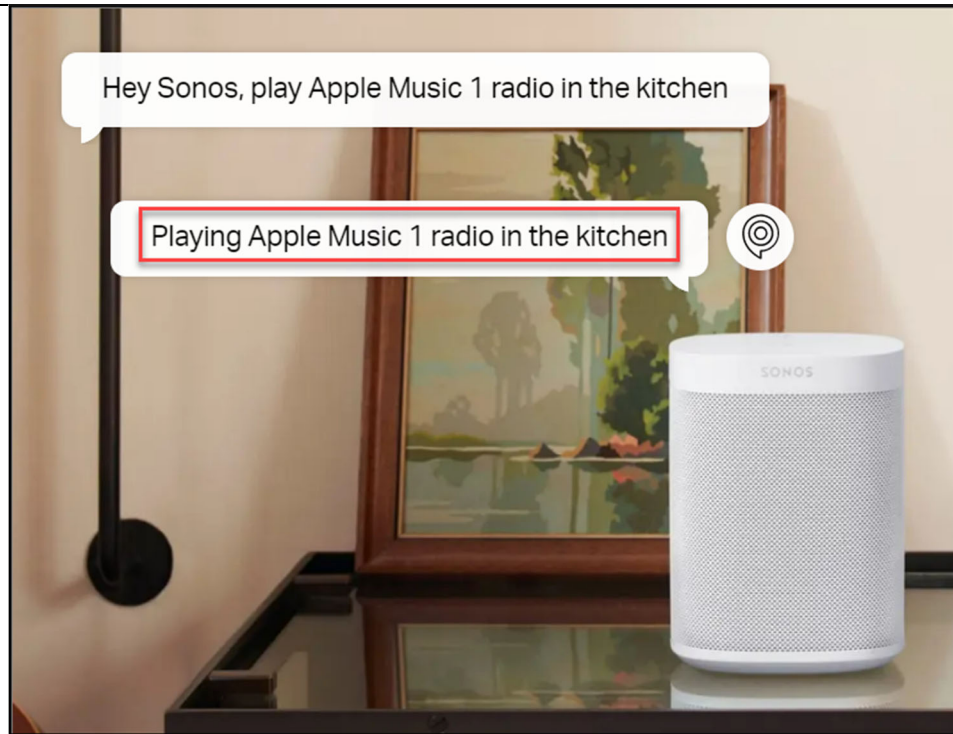
The Sonos One device remaining in the low power mode is further confirmed by messages transmitted by one of the Sonos One devices that detected the "Hey Sonos" hotword to the Sonos controller application, after the exchange of "WakeWord" messages. These messages include an "IdleState" value for each of the devices that detected the hotword. The "IdleState" value for the device that loses arbitration and does not respond to the user command is "1", indicating that it remains in the "Idle" mode:

Measurements of the power consumption of the Sonos One device further confirm that the device that loses arbitration and does not respond to the user's command remains in the "Idle" (i.e., low power) state.

On information and belief, each of the Accused Voice Products supports the features described above in the same way, and therefore meet this limitation in the same manner as the exemplary products identified above.

[9.pre] 9. A system comprising:	The Accused Voice Products are part of a system as further explained herein.
[9.1] one or more computers and one or more storage devices storing instructions that are operable, when executed by the	The Accused Voice Products are computers that comprise one or more storage devices storing instructions that are operable, when executed by the Accused Voice Products, to cause the Accused Voice Products to perform operations.

one or more computers, to cause the one or more computers to perform operations comprising:	For example, the Sonos One includes a central processing unit (CPU), software instruction, and 4GB of Non-Volatile (NV) memory and 1GB of Synchronous Dynamic Random Access Memory (SDRAM) that store the software instructions to perform elements [9.1.1] through [9.1.4].

	## Tech Specs Audio Details + Dimensions **Power + Connectivity** Box Contents Requirements **WiFi** Connect to WiFi with any 802.11a/b/g/n 2.4 or 5 GHz broadcast-capable router. Learn more **Voltage** 100-240V 50/60Hz internal power supply **Ethernet** 10/100 port for hardwiring to your router **CPU** Quad Core 1.4 GHz A-53 **Memory** 1GB SDRAM 4GB NV **Apple AirPlay 2** Works with AirPlay 2 on Apple devices iOS 11.4 and higher Learn more *See* Sonos One, Sonos.com, https://www.sonos.com/en-us/shop/one. Each of the other Accused Voice Products also include a central processing unit, software instructions, and storage devices storing the software instruction to perform operations. *See* https://www.sonos.com/en-us/shop/roam; https://www.sonos.com/en-us/shop/move; https://www.sonos.com/en-us/shop/arc; https://www.sonos.com/en-us/shop/beam.
[9.1.1] receiving, by a computing device that is in a low power mode and that is configured to exit a low power mode upon detecting an utterance of a particular, predefined hotword using an on-device	*See supra* [1.1].

hotword detector, audio data that corresponds to an utterance of a particular, predefined hotword;	
[9.1.2] while the computing device remains in the low power mode, and in response to receiving the audio data that corresponds to the utterance of the particular, predefined hotword, transmitting, by the computing device and to another computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an output of processing the audio data using the on-device hotword detector;	*See supra* [1.2].
[9.1.3] while the computing device	*See supra* [1.3].

remains in low power mode, receiving, by the computing device and from the other computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an additional output of processing the audio data; and	
[9.1.4] after transmitting the output of processing the audio data using the on-device hotword detector and after receiving the additional output of processing the audio data from the other using device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, determining, by the computing device, to	*See supra* [1.4].

remain in the low power mode.	
[16.pre] 16. A non-transitory computer-readable medium storing software comprising instructions executable by one or more computers which, upon such execution, cause the one or more computers to perform operations comprising:	The Accused Voice Products are computers that comprise a non-transitory computer-readable medium storing software comprising instructions executable by the Accused Voice Products which, upon such execution, cause the Accused Voice Products to perform operations. For example, the Sonos One includes a central processing unit (CPU), software instruction, and 4GB of Non-Volatile (NV) memory and 1GB of Synchronous Dynamic Random Access Memory (SDRAM) that store the software instructions to perform elements [16.1] through [16.4].

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Tech Specs

Audio   Details + Dimensions   **Power + Connectivity**   Box Contents   Requirements

WiFi
Connect to WiFi with any 802.11a/b/g/n 2.4 or 5 GHz broadcast-capable router.

Learn more

Voltage
100-240V 50/60Hz internal power supply

Ethernet
10/100 port for hardwiring to your router

CPU
Quad Core
1.4 GHz A-53

Memory
1GB SDRAM
4GB NV

Apple AirPlay 2
Works with AirPlay 2 on Apple devices iOS 11.4 and higher

Learn more

See Sonos One, Sonos.com, https://www.sonos.com/en-us/shop/one. Each of the other Accused Voice Products also include a central processing unit, software instructions, and storage devices storing the software instruction to perform operations. *See* https://www.sonos.com/en-us/shop/roam; https://www.sonos.com/en-us/shop/move; https://www.sonos.com/en-us/shop/arc; https://www.sonos.com/en-us/shop/beam.
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<tr><td>

[16.1] receiving, by a computing device that is in a low power mode and that is configured to exit a low power mode upon detecting an utterance of a particular, predefined hotword using an on-device
</td><td>

See supra [1.1].
</td></tr>
</table>

hotword detector, audio data that corresponds to an utterance of a particular, predefined hotword;	
[16.2] while the computing device remains in the low power mode, and in response to receiving the audio data that corresponds to the utterance of the particular, predefined hotword, transmitting, by the computing device and to another computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an output of processing the audio data using the on-device hotword detector;	*See supra* [1.2].
[16.3] while the computing device	*See supra* [1.3].

remains in low power mode, receiving, by the computing device and from the other computing device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, an additional output of processing the audio data; and	
[16.4] after transmitting the output of processing the audio data using the on-device hotword detector and after receiving the additional output of processing the audio data from the other using device that is configured to exit a low power mode upon detecting an utterance of the particular, predefined hotword, determining, by the computing device, to	*See supra* [1.4].

remain in the low power mode.	